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ABSTRACT

Since microcomputers are being used more and more frequently in the forest products industry in the Pacific Northwest, Green River Community College conducted a project to search for BASIC language computer programs pertaining to forestry, and when possible, to adapt such software for use in teaching forestry technology. The search for applicable software was conducted via telephone solicitation of local forestry organizations, and through a written survey distributed to forestry instructors at 13 schools in Oregon, Washington, Montana, and British Columbia. Through these means, 52 forestry-related programs were found that may be applicable for teaching forestry technology. However, many of these duplicate subject material and function, many are for surveying only, and there is a problem of compatability among computers. Five programs were prepared by the principal investigator and student programmers; two of these programs were modifications of existing programs contributed by public agencies, while three were the original design or a major revision by the investigator. All of the programs run only on an Apple II+ or IIe with 3.3 DOS. The project conclusion was that the most efficient way to create programs was by having student programmers work with a teacher, rather than by having the forestry teacher learn enough programming to create such programs. (A catalog of available programs applicable to forestry technology, along with extensive descriptions of the five programs created by the project, are included in this report.) (KC)

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COMPUTER SOFTWARE FOR FORESTRY TECHNOLOGY CURRICULA

FINAL REPORT

Project No. 84-ASM(147)NB

Curriculum Development Project
Conducted Under Public Law 94-482

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December 21, 1984

RESEARCH COORDINATING UNIT
Washington State Commission for Vocational Education

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The project reported herin was performed pursuant to a grant from the Research Coordinating Unit of the Washington State Commission for Vocational Education. Contractors undertaking such projects under the Commission for Vocational Education sponsorship are encouraged to express freely their professional judgement in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Commission for Vocational Education position or policy.

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December 21, 1984

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SUMMARY OF THE PROJECT

OBJECTIVES

The major objectives of this project were to search for basic language computer programs pertaining to forestry, and, when possible, adapt such software for use in teaching forestry technology. If suitable software could not be found, up to five programs were to be written for use in forestry technology teaching.

A search for applicable software was conducted via phone solicitation of local forestry organizations, and through a written survey distributed to forestry instructors at 13 schools in Oregon, Washington, Montana and British Columbia.

RESULTS

Fifty-two forestry related programs were found that may have applicability for teaching forestry technology. Many of these duplicated subject material and function, such as the eleven traversing or surveying programs that perform more or less the same function, though at differing levels of completness. While the survey solicited responses of only those programs written in "basic" language, there is still the problem of compatability between machines. Not all programs written in "basic" are interchangable, requiring the new user to modify the program to suit the particular machinery available. A copy of the survey instrument and compiled results is appended to this report.

Five programs were prepared by the principal investigator and student programmers. Two of these programs were modifications of existing programs contributed by public agencies: three programs were the original design or a major revision by the investigator. All of these programs run only on an Apple II+ or IIE with 3.3 DOS.

CONCLUSIONS AND RECOMMENDATIONS

While there is quite a bit of prepared forestry related computer software available, much of it is neither lanuage nor machine compatable with a particular school's hardware. Also, industry usage of software does not require it be "user friendly" nor well documented within the program, hence much revision and explanation is necessary for adaptation to classroom use.

Results were most efficiently obtained when a skilled programmer was acquainted with specific input/output needs. As the programmer began to develop the language, the investigator was available to modify

the input/output design. Knowledge of the desired output, and the input constraints of our discipline, was more valuable in obtaining a speedy and satisfactory result than if the investigator had tried to direct the writing of the program language.

Skilled programmers directed by imaginative educators familiar with the needs of their specific forestry curricula are both necessary to adapt existing programs for classroom use and to create new software for subject areas where none now exists.

INTRODUCTION

The need to find basic language computer software that is applicable to teaching forestry technology became evident as companies and agencies hiring forestry technicians began rapidly expanding their use of microcomputers. Forestry technicians are beginning to interface with microcomputers as part of their job. Training these technicians requires them to access computers to solve field problems similar to what they will find on the job.

Cataloging available software that is applicable to forestry in the Pacific Northwest was begun with the inventory survey of the forestry technology programs. The response to this survey indicates that some serious problems exist. First, while all respondents were using microcomputers, many different types of hardware, differing brands and different disk operating systems are used by the various schools. There is no standard evident at this time.

Second, there is very little software available that pertains specifically to forestry training. Most of the software relates to surveying.

Third, the enormous amount of time required to write software may cause forestry instructors to either avoid using computers, or, at best, divert much of their time toward helping skilled programmers design suitable software.

DESCRIPTION OF SOFTWARE PREPARED FOR THIS PROJECT

1. TRAVERSE

This program is an extensive and elaborate revision of a program contributed by James McEwen, a former graduate student at Washington State University, Department of Forestry and Range Management. The original program merely computed the error of closure, acreage, and adjusted coordinates based on an adjusted traverse. There was no format for hardcopy input/output, and the program lacked user direction.

Student programmer Tom Robertson and I redesigned this program extensively, including the feature of columner input/output hardcopy that was easy to read and understand. Also, the user has a method of correcting input mistakes, eliminating the necessity of re-entering all data. The option of inputting vertical angles in degrees, per cent or topographic units was added, and a choice of inputting lineal distances in feet or chains made the program more adaptable to various users. The ability to compute elevations and elevational error is a new feature.

This program is now usuable in any forest mapping class. Results can be obtained by a novice operator once a demonstration has been observed. Beginning forestry students were able to see the valuable time savings when this program was used to solve traverse problems.

2. SITE TABLES

Site index values for three common northwest tree species are calculated by this program when the operator enters total tree height in feet and breast high age (age at 4.5 feet above the root collar). Site index values for Red Alder, Western Hemlock and Douglas-fir are obtained using equations presented in the most commonly used western site index tables. This program is a modification of a program written by Charles Chambers, biometrician for the Washington Department of Natural Resources. Any forestry student who understands the concept of site index can use this program.

3. TREE HEIGHT PROBLEMS

This program randomly generates 10 tree heights measurement problems. The user is able to choose between lineal units of feet or chains, and vertical angle measurements in per cent or topographic units. The program then produces a set of problems on hard copy for the student to solve. A file is created in computer disk storage, identified by the student's name. After attempting to solve the problems, the student can return to the computer, retrieve the file, and compare answers. The computer scores the results for the student.

No program of this nature was available, so this instructional software was designed by the investigator and the program written by Ted Laurent, student programmer. This program will be useful in a tree measurements teaching unit.

4. SITE PREP PNW

Charles Chambers, biometrician for the Washington State Department of Natural Resources, donated this program in its original form. While the basic assumptions and equations have not been altered, the format has been changed to make the program more user friendly. This program is one which evaluates four site preparation methods commonly used in forest management and the subsequent cultural activities. By discounting the value of each event at a predetermined rate of interest, the user determines the best management scenerio for maximizing present net worth. This program can be used most effectively with forestry technology students who have nearly completed their training.

5. PCT BID

Tom Robertson, student programmer, wrote this program to enable students to use a simple "spread sheet" type program for bidding on

pre-commercial thinning contracts. Students are able to see the effect of changing one or more variables on the final bid price. Student knowledge of pre-commercial thinning contracting is necessary to understand the practical importance of the variables that underscore the success of any bid. Inexperienced students will probably not appreciate the importance of a slight alteration or cost or production values.

INDIVIDUAL PROGRAM INSTRUCTIONS

1. TRAVERSE

This program is so "user friendly" that very few instructions are needed. As with all programs, an experienced instructor should demonstrate the program to students before they are expected to use it alone. Before demonstrating this program, I suggest the instructor use a simple, short traverse for which the acreage, coordinates and error are known. This comparison will provide reassurance that the program is operating correctly.

TURN ON THE MACHINE AND BOOT UP THE DISK

SELECT 1) TRAVERSE

The default value is YES for all questions in this program.

COORDINATES: you may enter your own starting coordinates or use 0.0, 0.0 as the starting coordinates.

CORRECTIONS: you may correct an entry by using the "1" option at the end of each set of station data. This option merely drops the current entry and allows you to reenter the data for the current station. If the user checks each set of data carefully before continuing to the next station, input errors are eliminated. If an error escapes until the end of the program, the user may return to the questionable station by choosing option (3).

HARD COPY: a hard copy is generated, but NO file copy is kept in memory.

2. SITE TABLES

This small program uses the site index equations provided in the publications listed at the beginning of the program. These generally accepted site index equations are used by both industry and government agencies throughout western Washington. Users of this program outside western Washington should evaluate the appropriatness of these equations to their area, and, perhaps, use equations derived from local data.

TURN ON THE MACHINE AND BOOT UP THE DISK

SELECT 2) SITE TABLES

CHOOSE the desired species.

ENTER TOTAL HEIGHT: any value may be entered, so students must be careful to use realistic values.

BREAST HIGH AGE: because there are no limits on values being entered, age muct also be a realistic figure or the program will compute an unrealistic site index value.

3. TREE HEIGHT PROBLEMS

TURN ON THE MACHINE AND BOOT UP THE DISK

SELECT 3) TREE HEIGHT PROBLEMS

This program permits you to establish a file with your name or other identification. If you do not yet have a file, press RETURN and continue through the program.

Once you have chosen your lineal distance and vertical angle measurement units, the program generates 10 problems. There are limits set in the program to prevent unrealistic tree heights from being generated. No vertical angle measurements exceed 100% or 65 Topog, a guideline learned through field experience. Lineal measurements are likewise reasonable values.

A TABLE is now displayed. If you retrieved your FILE, you would now complete the table so that the machine could "grade" your answers. If you have no FILE, you can make a hard copy of this table to take with you for completion away from the computer.

An instructor can retrieve the correct answers by using the SHIFT-S keys in combination. The answers appearing on the screen can then be compared to the answers generated by the student.

When the students complete the assignment, they can retrieve their FILE and enter the answers in the blank spaces. The instructor can retrieve the correct answers for comparison. As long as the FILE is kept in memory, the original problems can be retrieved on hard copy, and the answers displayed on the screen. The answer CAN NOT be printed on hard copy.

4. SITE PREP PNW

TURN ON THE MACHINE AND BOOT UP THE DISK

SELECT 4) SITE PREP PNW

The purpose of this program is to calculate the present net worth of four different site preparation regimens. Since this program was modified from an industry original, it implies that the usuer understand the field situation. There must be sound, realistic bases for choosing the various options, values and treatments.

PER CENT PLANTABLE: after choosing the species to be grown and the site index, assign a percentage of the area that is plantable under each of the four regimens. Of course, the cleaner the ground after site preparation, the greater percentage of the area that can be planted.

AVERAGE TREES/ACRE: if the area is covered with slash, fewer trees can be planted, whereas a cleaner site preparation method will permit a more optimal initial spacing. Choose the trees/acre realistically based on the conditions you observed on the ground, or some experience basis.

TREATMENT COSTS/ACRE: local knowledge of contracted prices or agency/company costs for various site preparation methods is necessary to realistically complete this section.

PLANTING COSTS: these per acre costs should reflect the appropriate size of stock, labor/contractor costs and administrative costs.

POST STAND ESTABLISHMENT: this asks you to enter up to eight cultural treatments which you feel may occur in the stand when the particular site preparation method indicated was used, and the estimated cost of those treatments. For instance, under the "no site preparation" regimen, it may be necessary to control competition twice, at ages 2 and 5, at a cost of $28 per acre each time. At age 12 pre-commercial thinning may be needed at a cost of $85. per acre. A fourth treatment at age 20 may involve further stocking reduction at a cost of $75. per acre. All of these treatments and their cost should reflect the user's understanding and judgement of how these treatments relate to the type of site preparation initially chosen.

When all the desired cultural treatments have been entered press -1 to continue to the next portion of the program.

PRESENT NET WORTH: the PNW in dollars/acre of the 4 regimens is shown. You can run through the program again using diffenent assumptions, and the subsequent scenerios will be shown for comparison. Since this program does not print hard copy, it may be necessary to keep notes about your assumptions for future reference.

PNW is calculated using a 7% rate of return. Yields per acre and stumpage values per acre are based on assumptions made by Charles Chambers of the Department of Natural Resources regarding average diameters in stands of various stocking levels on differing sites at a predetermined rotation age.

5. PCT BID

TURN ON THE MACHINE AND BOOT UP THE DISK

SELECT 5) PCT BID

CONTRACT NAME AND UNIT: for future file reference, enter the name of the contract and the unit number.

STEMS PER ACRE: the information called for in this section is usually part of a bidding perspectus. Enter the appropriate values.

HOW MANY ACRES HAVE: this section is setting up variables which will decrease production rates. These added difficulties add to the hours needed to thin each acre. How many acres within the total acres have following four conditions. An average condition should be entered as "0" acres, as it will not contribute to extra difficulty.

1ST ESTIMATION: these production figures are based on stems per acre to cut and average diameter of stems to cut.

PLUS VARIABLES: these production figures take into account the difficulty factors you indicated in the preceding section.

ENTER 5 HOURLY WAGES: to get an assortment of results, use 5 hourly wage figures, including payroll loading costs.

This input results in a matrix of costs/acre based on 5 different wage rates.

ENTER 10 PRODUCTION RATES: DO NOT ENTER ZERO, or you will have to start over again. The matrix produced shows the bid costs at 5 different hourly wages and 10 different production rates. The top line shows the costs at the original production rate determined early in the program.

DISTRIBUTION OF MATERIALS

Outreach to other forestry technology programs has been established in two ways. First, a vehicle for inventory of program materials has been established through the survey of available software. This survey will be continually updated as new information is received. Thirteen forestry technology instructors have contributed, and more are expected.

Second, a floppy disk with the five new forestry programs and instruction materials has been sent to the four forestry technology programs in Washington state. (Green River, Centralis, Port Angeles and Spokane)

RECOMMENDATIONS AND CONCLUSIONS

As a result of this excercise, some strategies regarding procurement and use of computer software are developing. In order to use what is most readily available from industry and government agencies, a forestry technology program should have access to a basic language machine that uses CPM basic. In IBM-PC is an example of a machine commonly used in industry. Most basic language software can be adapted to a CPM basic machine: conversions from CPM to other basic language machines is not always possible.

Talented computer programmers are often enrolled as students in our community colleges. These individuals, for a modest wage, are often eager to use their talents for a good purpose, and to earn extra money. While most forestry instructors a capable of learning to program, it is more efficient to direct someone who is already a competent programmer. However, instructors should continue to learn as much about programming and computer usage as time will permit.

Green River Community College

12401 S.E. 320th St.
Auburn, Washington 98002
Auburn: (206) 833-9111
Seattle: (206) 464-6133
SCAN: 254-1313

April 16, 1984

Dear Forestry Instructor:

As you recall, I agreed to compile a catalog of computer software applicable to our technology programs. This project begins with your input of software that you are using.

Please use the blank catalog form to make as many copies as you need. Use one form for each program, please.

When I have received the responses, hopefully by June 1, I will compile a catalog for each school that answers the Survey. If you are not using any software, please respond anyway, and I will send a catalog.

Thanks for your promptness.

Very truly yours,

Walter Scobie
Forestry Instructor

Encl.

SURVEY OF FORESTRY COMPUTER SOFTWARE
WESTERN FORESTRY TECHNOLOGY PROGRAMS

1. Computer Program Title: _____

2. Can this program be legally copied? _____yes _____no

3. Machine or DOS System: _____

Source Information:

4. School: _____

5. Contact Person: _____

6. Address: _____
Zip Code

7. Phone: _____

8. Abstract of Program:

9. Comments:

10. Date:

Green River Community College

12401 S.E. 320th St.
Auburn, Washington 98002
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Tacoma:(206) 924-0180
SCAN 254-1313/1314

October 3, 1984

To: Forestry Technology Instructors

From: Walt Scobie, Instructor
Green River Community College

Subject: Inventory of Computer Software

Attached is the first attempt at cataloging computer software that pertains to the courses we teach. While the list may seem small, consider that there were only a few schools responding. Perhaps the list will grow with the increased need for software and the greater use of microcomputers.

The descriptions of the programs are brief. You should contact the source if you feel the program is of interest and you would like more descriptions. Placing a program in this inventory implies that these people will share the program if they are provided with a blank diskette.

In the future, I will update the listing when new information about programs is received. Perhaps the annual Forum will enable me to enlist new programs and send the updated catalog to you. I have these on our data base program and updating is relatively simple.

Also, be aware of the computer software network called Forest Resource Systems Institute (FORS). This organization collects software and publishes a regular newsletter. They seem, initially, to be centered in the Southeast. Their address is:

Forest Resources Systems Institute
Post Office Box X
Norris, Tennessee 37828

Those of you who responded deserve my thanks. I assume the other schools have no programs or will respond when they see something has been done.

Best of luck this year with your enrollments and placement. It can't get much worse.

Very truly yours,

Walter R. Scobie
Forestry Instructor

WS/jh

SOURCE LIST FOR COMPUTER SOFTWARE
FORESTRY TECHNOLOGY PROGRAMS
September 1984

The following list of persons and places is a source of either program duplicates or information describing the program listed in the inventory. These persons can advise you accurately regarding program usage.

1. Jack Alley
   909 South Avenue West
   Missoula, MT 59801
   (406) 721-1330 Ext. 241
   Missoula Vocational Technical Center

2. John Hamilton
   Lassen College
   P.O. Box 3000
   Susanville, CA 96130
   (916) 257-2107

3. Monica Spicks
   Spokane Community College
   N. 1810 Greene Street - MS 2080
   Spokane, WA 99207-5399
   (509) 536-7265

4. Tim Dunn
   Chemeketa Community College
   P.O. Box 14007
   Salem, OR 97325
   (503) 399-5061

5. Bill MacDonald
   Missoula Vocational Technical Center
   909 South Avenue West
   Missoula, MT 59801
   (406) 721-1330, Ext. 241

6. Al Chase
   Missoula Vocational Technical Center
   909 South Avenue West
   Missoula, MT 59801
   (406) 721-1330, Ext. 241

7. Rich Niederhof
   Central Oregon Community College
   Bend, OR 97701
   (503) 382-6112, Ext. 363

INVENTORY OF COMPUTER SOFTWARE
FORESTRY TECHNOLOGY SCHOOLS

TIMBER CRUISING AND SCALING

"3-P2" Zenith 100, Basic, (1)*
Calculates the volume of a 3-P cruise by species and accuracy of cruise.

"CRZPLTF" Zenith 100, Basic (6)
Calculates the number of fixed plots necessary to arrive at a pre-assigned accuracy for a fixed plot cruise.

"CRUSTY" Zenith 100, Basic (6)
Calculates the accuracy of a fixed plot cruise and, if the cruise did not meet the original accuracy objective, calculates the number of plots needed to meet the objective.

"UNCLAL" Zenith 100, Basic (6)
Calculates the volume, by species, and total volume for fixed plot cruise.

"CRUSTY2" Zenith 100, Basic (1)
Calculates the accuracy of a variable plot cruise based on measured plots.

"VIP" Zenith 100, Basic (1)
Calculates the volume by species and total volume of a variable plot cruise using measured, or measured and count plots.

"CRZPLT" Zenith 100, Basic
Calculates the number of measured plots necessary to arrive at a pre-assigned accuracy for variable plot cruise.

"PLOT FILE" and "PLOT CRUZ" Apple II (2)
Plot File is the cruise information file and Plot Cruz provides calculation of volume by species, type, cull percentage.

"FORTECH" DOS - TRS-80 Model III (3)
A series of 15 programs written specifically for forest technicians to teach data entry, computer use, decision making and evaluation of field data.

The programs include:

(1) closed traverse analysis: lats, deps, closure via compass rule, area by DMD

(2) tree ages and site index

(3) form class and volumes

* (1) denotes source of programs as described on the enclosed source address list.

(4) plot spacing for cruises

(5) random number generator for 3-P cruises

(6) cruise evaluation for fixed radius plots

(7) prism cruise evaluation

(8) 3-P cruise evaluation

(9) general statistics

(10) percent growth from field data

(11) growth simulator

(12) KAMAS Lumber Company Game - a decision/management game from the University of Iowa.

A comprehensive users manual accompanies the disk of programs.

"LOG SCALING" Apple II+, one drive, 48K (4)
Computes log volumes (Scribner Decimal C) when scaling data are inputed. Will print out the information in log scale ticket form.

"FOREST INVENTORY PACKAGE", including: Apple II+, (8), (9)

"TARVOL" - computes Tarif number and tree volumes

"RANSAM" - random sampling for timber cruises

"STRAS" - stratified sampling for timber cruises

"DOSAM" - double sampling for timber cruises

SURVEYING

"COORD" Zenith 100, Basic (5)
Calculates coordinates of stations in open or closed traverses. It will adjust closed traverse, calculate area by D.M.D. and determine total error and error ratio.

"TRAVER2" Zenith 100, Basic (5)
Same as TRAVERSE only computations are in chains.

"TRAVERSE" Zenith 100, Basic (5)
Computes latitudes and departures, corrections, areas and precision of closed traverse. Computations are in feet.

"CLOSED TRAVERSE" DOS, written for Apple II+ 48K (4)
Uses interior angles, distance of sides and base bearing to balance the interior angles and correct the traverse using the compass rule method. Prints corrected angles, original data, adjusted data, error of closure, accuracy or precision and area in acres.

"TRAVERSE" Apple II+ 48K (8)
Accepts field data in feet or chains with vertical angle in topographic units, percent or degrees. Prints input in tabular form. Calculates error of closure, acres, and correct coordinates. Prints results.

TI-59 and HP-85 Survey Packet (7)
Both programs cover all basic survey calculations: primary use is traverse plotting, error of closure and area calculations.

"FORTECH" DOS- TRS-80 Model III (3)
Closed traverse analysis, lats, deps, closure via compass rule, area by DMD.

"TOPO" Apple DOS 3.3 (1)
A simplistic but cheap ($50) program by Apple. It does LORES and HIRES plots of land-forms and slope analysis. Also shows areas receiving sunshine at various angles of sun. A supplemental machine language routine is available to speed up the standard version.

"MICRO MAP 2" Apple DOS 3.3 (10)
A powerful complex to produce HIRES maps of topography including perspective views of landforms. Also has graphing capability. Expensive at $650.

"IMPROVED TRAVERSE" Apple IIE (10)
Computes lats and deps and profiles.

"TRAVERSE 3" DOS (13)
Computes lats and deps and cumulative lats and deps and elevations of a traverse. Also gives a rough plot of plan and profile.

ROAD ENGINEERING

"EWKS" Zenith 100, Basic (5)
Computes earthwork volumes by average end area of road prisms.

"CURVE1" Zenith 100, Basic (5)
Computes the elements of a simple highway curve (radius, degree of curve, length, tangent distance, long chord).

"CURVE2" Zenith 100, Basic (5)
Computes elements of a simple highway curve, (radius, external distance, length, tangent distance, long chord).

"GRADE" Zenith 100, Basic (5)
Computes the grade elevations, cuts or fills, etc., from a profile leveling problem.

"PROLEV" Zenith 100, Basic (5)
Calculates elevations of stations and turning points in profile leveling.

"DIFLEV" Zenith 100, Basic
Computes the elevations of stations in differential leveling problem.

"BRIDGE REACTION MODEL" (11)
Calculates support reacitons for a user defined truck axle loading and axle spacing when the truck is arbitrarily placed on the bridge, or with each axle on the near support in turn. A simple graph illustrates the position and [illegible]em of the bridge.

GROWTH AND YIELD

"SITE INDEX" Apple II+ (8)
Computes site index for Douglas-fir, Western Hemlock and Red Alder for Western Washington using currently accepted tables and 50 year base.

"MICRO SIMCON" 3.3 Apple DOS (10)
A very versatile population simulation model. Permits user to vary age groups, mortality, etc. Permission needed to copy.

"HARVEST" Xerox Sigma 6. Basic. Easily adapted to other Basic machines. (14)
An interactive harvest scheduling simulator for even-aged forests. Given a forest's age class distribution, this program gives volume and area control harvest levels. A good tool for discussion of sustained yield as something more than just a phrase.

ECONOMICS AND VALUATION

"SITE PREP PNW" Apple II+ (8)
A present net worth analysis of site preparation, reforestation and cultural treatments for three species (DF, WH, TF) in western Cascade situations.

TREE MEASUREMENTS

"TREE HEIGHTS" Apple II+ (8)
An instructional program that generates randomly 10 tree heights problems using either feet and percent abney or chains and topog abney. Students can obtain print out of problems for calculations and save problems in a storage file. Answers can be compared to computer results.

Inventory of Cumputer Software
Forestry Technology Schools

FIRE

"FIRE" Zenith 100 Basic (5)
Forest fire simulation: use of backfires and retardent drops to stop spread of a wildfire.

MISCELLANEOUS

"GRAPHICS DEPT.: Apple DOS 3.3 (10)
A comprehensive program for preparing graphic presentations of data and some data analysis (linear regression).